



# Libby Asbestos Site, Operable Unit 4 Libby, Montana

## Final Sampling and Analysis Plan Remedial Investigation Contaminant Screening Study

April 2002



## *Sampling and Analysis Plan*

## **TECHNICAL MEMO 1**

### **CONCORDANCE BETWEEN VISIBLE VERMICULITE AND THE OCCURRENCE OF ASBESTOS BY PLM IN SOIL AND SOIL-LIKE MEDIA**

#### **1.0 INTRODUCTION**

USEPA Region 8 is currently planning a large-scale investigation to identify potentially significant sources of asbestos in and about the community of Libby. Because of the cost and time required to perform a microscopic analysis of each potential source material, EPA wished to evaluate the reliability of the assumption that when visible vermiculite was present in a sample of soil-like media that asbestos would be observable by polarized light microscopy (PLM) in that sample. This technical memo summarizes the data bearing on that question.

#### **2.0 APPROACH**

A query of the Libby database was performed on 05/03/02. All samples of soil or soil-like media (this does not include insulation) were reviewed to determine if the word "vermiculite" occurred in the comment field. A query was designed to isolate those samples in which the comment indicated that vermiculite was visible by eye, and all such samples were then classified into four bins according to the results of an analysis for asbestos by PLM:

- No PLM results available
- Non-detected
- Trace (asbestos visible by PLM, but level is too low to provide a quantitative estimate)
- Quantifiable ( $\geq 1\%$  asbestos by mass)

The design of the query and the resulting output are provided as Attachment 1.

#### **3.0 RESULTS**

A total of 568 soil or soil-like samples were located in which the comment field indicated that visible vermiculite was present. Of these, PLM results were available for 567. These PLM results are summarized below:

PLM Result	Number of Samples	Percent of Total
Non-detect	145	26%
Trace	303	53%
Quantifiable ( $\geq 1\%$ )	119	21%

As seen, 74% of the samples had detectable (trace or higher) levels of asbestos present, with 21% being above the quantitation limit (about 1%). This indicates that most samples with visible vermiculite also contain asbestos by PLM.

Samples of soil and soil-like media containing visible vermiculite have been collected from a wide variety of locations around the Libby site. In order to determine if the frequency of detectable asbestos in samples with visible vermiculite depends on the land use category, the samples were stratified into four bins, as shown in Table 1. As seen, the frequency of PLM-detectable asbestos in soil samples is 70% or greater in all cases, supporting the conclusion that the association of asbestos with visible vermiculite is not a function of land use category.

In order to determine if there is any spatial pattern to the occurrence of vermiculite and asbestos in soil, several maps (Figure 1A, 1B, 1C, 1D) were prepared to show the location of soil samples that contained visible vermiculite<sup>1</sup>, color-coded to indicate the results of the PLM analysis for asbestos (blue = ND, orange = trace, red = 1% or greater). As shown in Figure 1C, a majority of the samples that contained 1% asbestos were located at the screening plant. This is perhaps expected, since soil at this site was generally more heavily contaminated with vermiculite than at most other locations. In the residential and commercial area of Libby, but no clear pattern of occurrence of asbestos level was apparent.

#### 4.0 CONCLUSION

Based on the high concordance between the occurrence of visible vermiculite in soil and soil-like media and the presence of detectable (trace or quantifiable) levels of asbestos fibers by PLM, it is concluded that the presence of visible vermiculite in soil at the Libby site is a reliable and useful indicator of the presence of elevated levels of asbestos.

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<sup>1</sup> Not all locations with visible vermiculite in soil are shown in the maps, since coordinates are not available for all sampling locations.

**Table 1. Summary of PLM Results for Soil and Soil-Like Media with Visible Vermiculite Present**

PLM Result	Screening/Export		Schools		Residential/Commercial		Landfill	
	Number of Samples	Percent of Total	Number of Samples	Percent of Total	Number of Samples	Percent of Total	Number of Samples	Percent of Total
Non-detect	2	3%	5	19%	135	30%	3	21%
Trace(<1%)	18	25%	9	35%	265	58%	11	79%
Quantifiable ( $\geq 1\%$ )	52	72%	11	42%	56	12%	0	0%

# Color Map(s)

The following pages  
contain color that does  
not appear in the  
scanned images.

To view the actual images, please  
contact the Superfund Records  
Center at (303) 312-6473.

# Libby, Montana

## Locations of Soils With Visible Vermiculite

Figure 1A

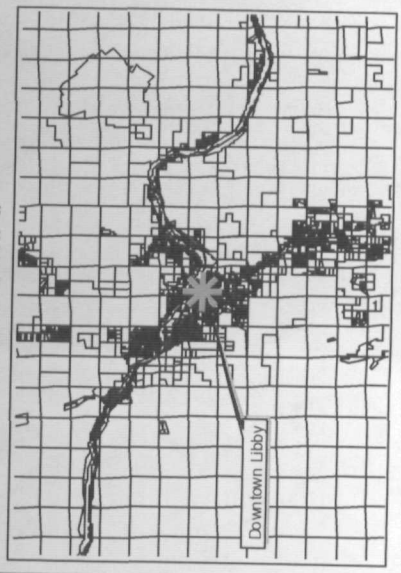
Asbestos Levels  
In Soil (by PLM)

Soil Sample Results

- ND
- TRACE
- ≥1%

Approximate Parcel  
Boundaries

LOCUS MAP



May, 2002

Map Projection UTM Zone 11 NAD83 FT



**CDM**

2500 0 2500 Feet





# Libby, Montana

## Locations of Soils With Visible Vermiculite

Figure 1B

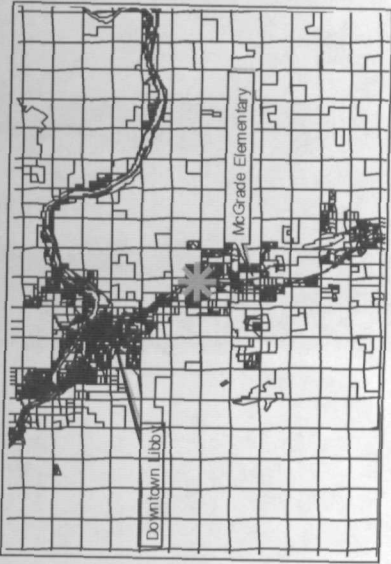
Asbestos Levels  
In Soil (by PLM)

Soil Sample Results

- ND
- TRACE
- ≥1%

Approximate Parcel  
Boundaries

LOCUS MAP



May, 2002

Map Projection UTM Zone 11 NAD83 FT



5000 0 5000 Feet

Libby, Montana  
Locations of Soils  
With Visible Vermiculite

Figure 1C

Asbestos Levels  
In Soil (by PLM)

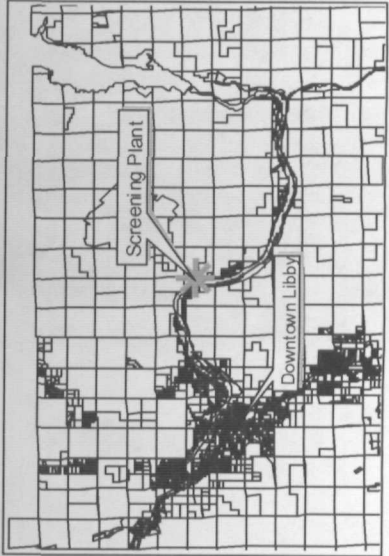
Soil Sample Results

- ND
- TRACE
- ≥1%

Approximate Parcel  
Boundaries



LOCUS MAP



May, 2002  
Map Projection UTM Zone 11 NAD83 FT



CDM

2000 0 2000 Feet





# Libby, Montana

## Locations of Soils With Visible Vermiculite

Figure 1D

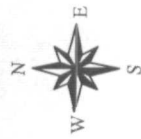
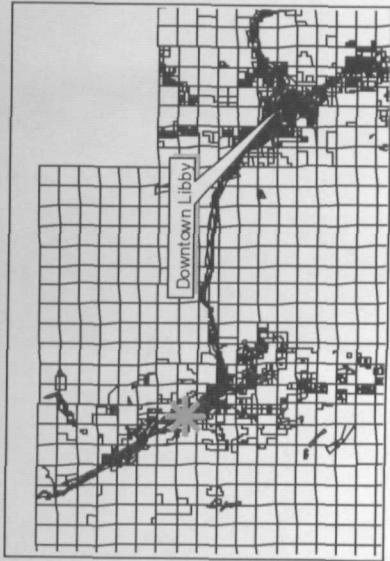
Asbestos Levels  
In Soil (by PLM)

Soil Sample Results

- ND
- TRACE
- $\geq 1\%$

Approximate Parcel  
Boundaries

LOCUS MAP



May, 2002

Map Projection UTM Zone 11 NAD83 FT



**CDM**

2000 0 2000 Feet

**TARGET SHEET**  
EPA REGION VIII  
**SUPERFUND DOCUMENT MANAGEMENT SYSTEM**

DOCUMENT NUMBER: 2009461

SITE NAME: LIBBY ASBESTOS

DOCUMENT DATE: 04/01/2002

**DOCUMENT NOT SCANNED**

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- ☐ PHOTOGRAPHS
- ☐ 3-DIMENSIONAL
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**DOCUMENT DESCRIPTION:**

Technical Memo 1  
Attachment 1 Data  
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## **TECHNICAL MEMO 2**

### **OCCURRENCE OF ASBESTOS IN LIBBY VERMICULITE INSULATION**

#### **1.0 INTRODUCTION**

USEPA Region 8 is currently planning a large-scale investigation to identify potentially significant sources of asbestos in and about the community of Libby. Available data from the site support the conclusion that Libby vermiculite insulation (LVI) contains asbestos fibers, and that disturbance of the LVI can lead to release of asbestos fibers into air (Weis 2001a, 2001b). Thus, LVI is one of the sources of chief public health concern to EPA at the Libby site.

Because of the cost and time required to perform a microscopic analysis of each LVI sample, EPA wished to assess the reliability of the assumption that all samples of LVI should be considered a potential source of asbestos fibers. This technical memo summarizes the data bearing on that question.

#### **2.0 APPROACH**

A query of the Libby database was performed on 05/03/02 to isolate all samples that were classified as "insulation". These samples were classified into four bins according to the results of an analysis for asbestos by polarized light microscopy (PLM):

- No PLM results available
- Non-detected
- Trace (asbestos visible by PLM, but level is too low to provide a quantitative estimate)
- Quantifiable ( $\geq 1\%$  asbestos by mass)

The design of the query and the resulting output are provided as Attachment 1.

#### **3.0 RESULTS**

A total of 126 insulation samples were located. Of these, 125 had results of an analysis by PLM. These results are summarized below:

PLM Result	Number of Samples	Percent of Total
Non-detect	33	26%
Trace	84	67%
Quantifiable ( $\geq 1\%$ )	8	6%

As see, 74% of the insulation samples had detectable (trace or higher) levels of asbestos present, with 6% being above the quantitation limit.

In order to determine if there is any spatial pattern to the occurrence of LVI and the occurrence of detectable asbestos in the insulation, a series of maps (Figures 2A, 2B, 2C) were prepared to show the location of LVI samples that have been collected<sup>1</sup>, color coded to indicate the results of the PLM analysis (blue- non-detect, orange = trace, red = 1% or higher). Inspection of these maps does not reveal any clear spatial pattern, either for the occurrence of LVI, or for the level of asbestos reported in the LVI.

#### 4.0 CONCLUSION

Based on the high fraction of LVI samples from the Libby site that contain detectable levels of asbestos by PLM, coupled with the evidence that disturbance of LVI leads to the release of asbestos fibers into air (Weis 2001a, 2001b), it is concluded that it is reasonable and appropriate to assume that LVI at the Libby site is a probable source of asbestos fibers, and that individual analysis of each sample of LVI is not necessary or cost effective to make decisions regarding the potential risk from this material at this site.

#### 5.0 REFERENCES

- Weis, C.P. 2001a. Fibrous Amphibole Contamination in Soil and Dust at Multiple Locations in Libby Poses an Imminent and Substantial Endangerment to Public Health: an Addendum to my Memorandum of May 10, 2000. Memorandum from Christopher P. Weis, USEPA Regional Toxicologist, to Paul Peronard, USEPA On-Scene Coordinator for the Libby Asbestos Site. Dated 07/11/2001.
- Weis, C.P. 2001b. Amphibole Mineral Fibers in Source Materials in Residential and Commercial Areas of Libby Pose an Imminent and Substantial Endangerment to Public Health. Memorandum from Christopher P. Weis, USEPA Regional Toxicologist, to Paul Peronard, USEPA On-Scene Coordinator for the Libby Asbestos Site. Dated 12/18/2001.

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<sup>1</sup> Not all samples of LVI are shown on the maps because coordinate information is not available for all samples.



# Libby, Montana

## Locations of Buildings With Libby Vermiculite Insulation

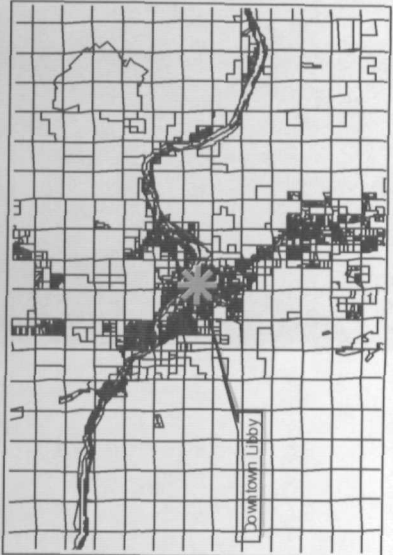
### Figure 2A

Soil Sample Results

- ND
- TRACE
- ≥1%

Approximate Parcel Boundaries

LOCUS MAP



May, 2002

Map Projection UTM Zone 11 NAD83 FT



**CDM**

2500 0 2500 Feet



# Libby, Montana

## Locations of Buildings With Libby Vermiculite Insulation

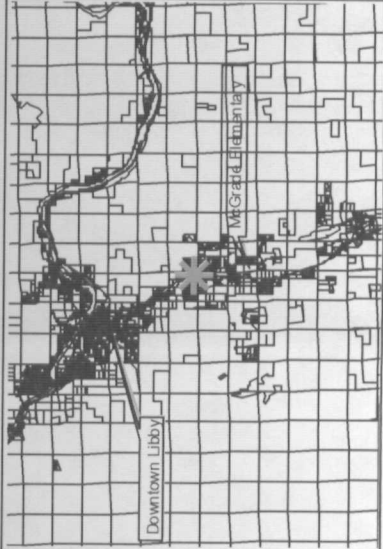
Figure 2B

Soil Sample Results

- ND
- TRACE
- ≥1%

Approximate Parcel Boundaries

LOCUS MAP



May, 2002



Map Projection UTM Zone 11 NAD83 FT



**CDM**

2500 0 2500 Feet





# Libby, Montana Locations of Buildings With Libby Vermiculite Insulation

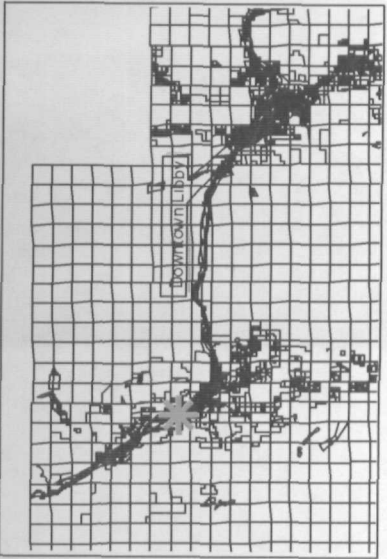
Figure 2C

Soil Sample Results

- ND
- TRACE
- ≥1%

Approximate Parcel  
Boundaries

LOCUS MAP



May, 2002

Map Projection UTM Zone 11 NAD83 FT



CDM



**TARGET SHEET**  
EPA REGION VIII  
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DOCUMENT NUMBER: 2009461

SITE NAME: LIBBY ASBESTOS

DOCUMENT DATE: 04/01/2002

**DOCUMENT NOT SCANNED**

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## **TECHNICAL MEMO 3**

### **EVALUATION OF THE NEED FOR INDOOR DUST SAMPLING AT BUILDINGS IN LIBBY WHERE VERMICULITE INSULATION IS PRESENT**

#### **1.0 INTRODUCTION**

USEPA Region 8 is currently planning a large-scale investigation to identify potentially significant sources of asbestos in and about the community of Libby. One of the sources of concern to EPA is Libby vermiculite insulation (LVI). This material has been shown to be capable of releasing relatively high concentrations of asbestos fibers into air when disturbed (Weis 2001a, 2001b, Grace 1976).

A second medium of potential concern at a building with LVI is indoor dust. This is because any asbestos fibers that have been released from the LVI or other sources may become entrained in indoor dust, and the dust may serve as a secondary source even after the primary source (e.g., the LVI) has been removed or contained.

Because of the cost and time required to perform a microscopic analysis of dust samples at each building where LVI is found to be present, EPA wished to consider whether it was reasonable to assume that dust at such a location might be a potential secondary source, and take steps to remove the dust without the need for sampling. This technical memo presents an assessment of the pros and cons of that approach.

#### **2.0 DATA SUMMARY**

A query of the Libby database was performed on 05/03/02. First, a list of all samples of vermiculite insulation was prepared, and a list was prepared of the addresses of the locations where these samples were collected. Next, a list of all dust samples that were collected at any of the same locations (i.e., at buildings with LVI present) was prepared. Finally, the results of transmission electron microscopy (TEM) examination of these dust samples were tabulated and classified into two bins (detect or non-detect). Detects were defined as samples in which one or more Libby-class amphibole fibers were observed that had either a) an aspect ratio  $\geq 5:1$ , thickness  $\leq 0.5 \mu\text{m}$  and length  $\geq 5 \mu\text{m}$ , or b) an aspect ratio  $\geq 5:1$  and thickness  $> 0.5 \mu\text{m}$ . These dimensions were used because they include the size range suspected to be of greatest potential human health concern. Samples were assigned to the "Non-detect" bin if they did not contain one or more of the fibers above (even if Libby-class amphibole fibers were observed

outside these size bins).

The design of the query and the resulting outputs are provided as Attachment 1. The results are summarized below:

TEM Result	Number of Dust Samples	Percent of Total
Non-detect	230	75%
Detect	75	25%
Total	305	100%

### 3.0 DISCUSSION

As seen, about 25% of the dust samples collected at locations with LVI had observable levels of Libby class amphibole fibers. Superficially, this would suggest that cleaning up indoor dusts at all locations with LVI might not be necessary in a number of cases, and that testing of dust before cleaning might be appropriate.

However, there are several reasons why the testing of all dusts may not be necessary or effective at this site. First, the detection limits for asbestos fibers in dust samples from the site are generally in the range of 250-300 f/cm<sup>2</sup>, with a number of detection limit values in excess of 1,000 f/cm<sup>2</sup> (depending on the number of grids examined and the relative level of debris in the sample). Thus, in many cases, a non-detect result is not strong evidence that no fibers are actually present.

Second, even in the case that the LVI in a building has not released any fibers into indoor dust, fibers might be released to dust as a consequence of the LVI removal activity. While EPA will seek to prevent the release of asbestos fibers from LVI into the remainder of the building during removal activities, the possibility of some fiber contamination cannot be totally excluded. Because of this, EPA will perform a "clearance test" at the end of each LVI removal to establish that it is safe for the occupants of the building to re-enter the space. Because the occupants of the building must be absent from the premises until this test has been completed, there is a premium on the most time-effective approach for determining if re-entry is permissible. If the procedure for establishing clearance required collection and analysis of dust samples before a decision could be made as to whether dust removal was needed, the time before clearance testing would be extended by the length of time needed to collect and analyze the dust sample. This period of time will vary, but not likely to average less than about 3 days. Conversely, if EPA simply performed a dust cleaning immediately upon completion of the LVI removal, and

followed this by the clearance test, clearance could be achieved in 1-2 days.

Finally, the incremental cost of performing automatic dust cleanups without prior testing are not expected to be substantial compared to the cost of testing before dust removal. The estimated relative costs are compared in the following table:

Activity	Cost per 100 Buildings	
	Optioun 1 Test dust before cleanup	Option 2 Cleanup dust without test
Dust collection (a)	\$62,500	\$0
Dust analysis (b)	\$140,000	\$0
Dust cleanup (c)	\$225,000	\$450,000
Total cost	\$427,500	\$450,000

(a) Assumes 3 composite samples and one blank per location

(b) Assumes 25 grid openings counted per sample

(c) Assume that 50% of post remediation dust samples contain asbestos, indicating the need for dust removal before clearance

#### 4.0 CONCLUSIONS

Based on a consideration of the long turnaround time before clearance if dust testing is required as well as the uncertainty associated with a non-detect in dust, it is concluded that it is reasonable and appropriate to perform an indoor dust removal at all homes in Libby that undergo LVI removal, and that this step is not contingent upon testing the dust for asbestos contamination. Any increment in cost (about 5% of the total cost) for Option 2 are more than justified by the decreased delay in allowing re-entry of building occupants, and will be partially or entirely defrayed by reduced per diem costs.

#### 5.0 REFERENCES

Grace, W.R.. 1976. Controlled Drop Air Sampling, July 23. Memo to HA Brown et al. Dated August 5, 1976. (103Z00768).

Weis, C.P. 2001a. Fibrous Amphibole Contamination in Soil and Dust at Multiple Locations in Libby Poses an Imminent and Substantial Endangerment to Public Health: an Addendum to my Memorandum of May 10, 2000. Memorandum from Christopher P. Weis, USEPA Regional Toxicologist, to Paul Peronard, USEPA On-Scene Coordinator for the Libby

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